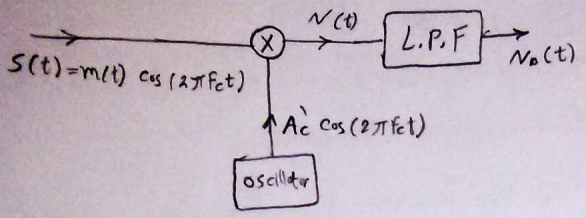
اتصالات

DSBSC Demodulator

[1] Coherent detector: متزامن



$$v(t) = s(t) \cdot A_c' \cos(2\pi f_c t)$$

$$= m(t) \cdot A_c \cdot A_c' \cos^2(2\pi f_c t)$$

$$= \frac{m(t) A_c A_c'}{2} [1 + \cos(4\pi f_c t)]$$

$$= \frac{A_c A_c'}{2} m(t) + \frac{A_c A_c'}{2} m(t) \cos(4\pi f_c t)$$

after L.P.F

$$N_o(t) = \frac{A_c A_c'}{2} m(t)$$

* IF there is phase shift (ϕ)

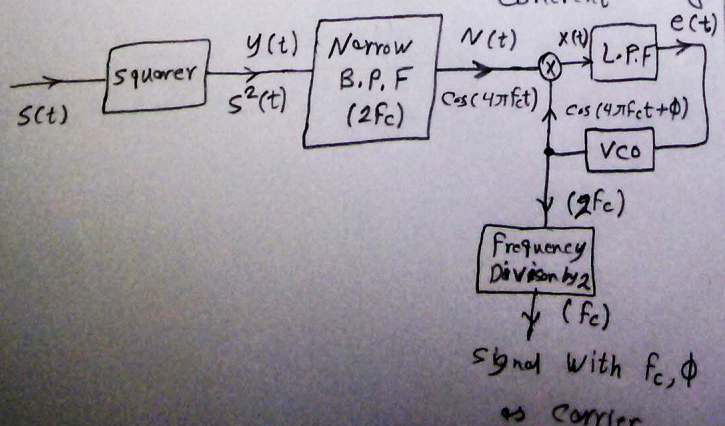
$$v(t) = \frac{A_c A_c'}{2} m(t) [\cos\phi + \cos(4\pi f_c t + \phi)]$$

$$N_o(t) = \frac{A_c A_c'}{2} m(t) \cos\phi$$

If $\phi = \frac{\pi}{2}, \frac{3\pi}{2} \rightarrow N_o(t) = 0$

[2] Square Loop:

*الهدف من هذه الدائرة هو تكوين إشارة لها نفس تردد ونفس الـ phase Corner الموجودة في S(t) لإستخدامها Coherent



$$y(t) = s^2(t)$$

$$= \frac{m^2(t) A_c^2}{2} (1 + \cos(4\pi f_c t))$$

$$v(t) = \frac{m^2(t) A_c^2}{2} \cos(4\pi f_c t)$$

نتيجة بعض خصائص الفلتر

$$v(t) = \frac{E \Delta f A_c^2}{2} \cos(4\pi f_c t)$$

$\Delta f \rightarrow$ Bandwidth of Filter

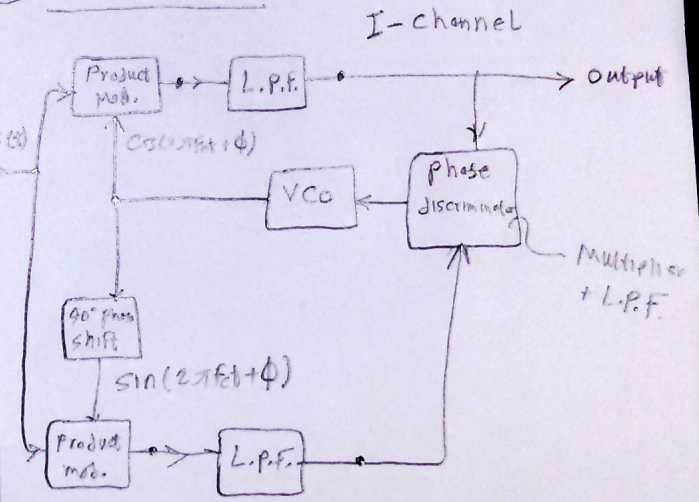
$E \rightarrow$ Energy of Signal

$$X(t) = K [\cos\phi + \cos(8\pi f_c t + \phi)]$$

$$e(t) = K \cos\phi$$

* هذه الإشارة تقوم بتغيير phase بشكل مستمر حتى يصبح لها نفس Corner الـ phase

[3] Costas Reciver:



At I-ch. at product mod.

$$\frac{A_c}{2} m(t) [\cos\phi + \cos(4\pi f_c t + \phi)]$$

at L.P.F.

$$\frac{A_c m(t)}{2} \cos\phi$$

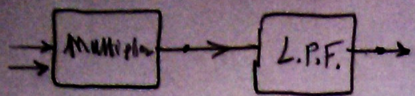
At Q-ch. at product Mod.

$$\frac{A_c}{2} m(t) [\sin\phi + \sin(4\pi f_c t + \phi)]$$

at L.P.F.

$$\frac{A_c m(t)}{2} \sin\phi$$

Phase Discriminator



$\frac{A_c^2}{8} m^2(t) [\sin(0) + \sin(2\phi)]$

at L.P.F

↳ ?!

Q - ch → Quadrature phase shift

$\frac{\pi}{2}$ phase

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let $m(t) = A_m \cdot \cos(2\pi f_m t)$

$m^2(t) = \frac{A_m^2}{2} [1 + \cos(4\pi f_m t)]$

after L.P.F

$\frac{A_m^2}{2}$

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output of phase discriminator

$K \sin(2\phi)$

هذه الإشارة تقوم بتعديل phase ال VCo

حتى يصل لل phase المطلوب

Report

$u(t) = 100\ m(t) \cdot \cos(2\pi F_c t)$

$F_c = 1$ MHz

$m(t) = 2\cos(2\pi \cdot 10^3 \cdot t) + \cos(2\pi \cdot 3 * 10^3 t)$

a) Find and sketch spectrum

b) Find the avg. power of each Freq. component